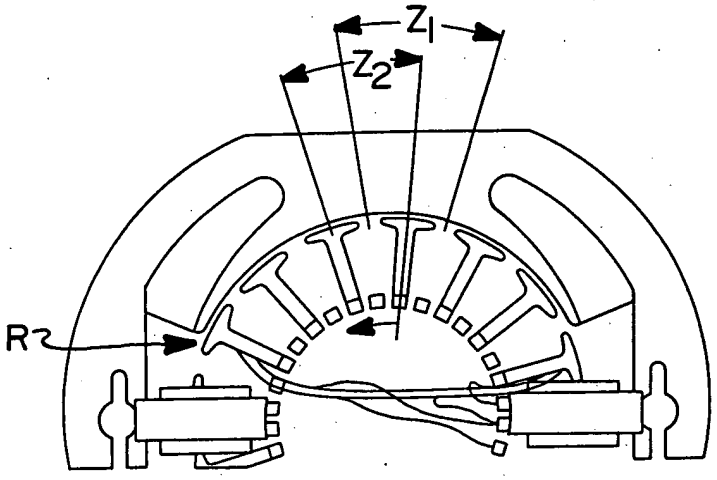
OIPE
MAY 26 2005
PATENT & TRADEMARK OFFICE

FIG 1
PRIOR ART



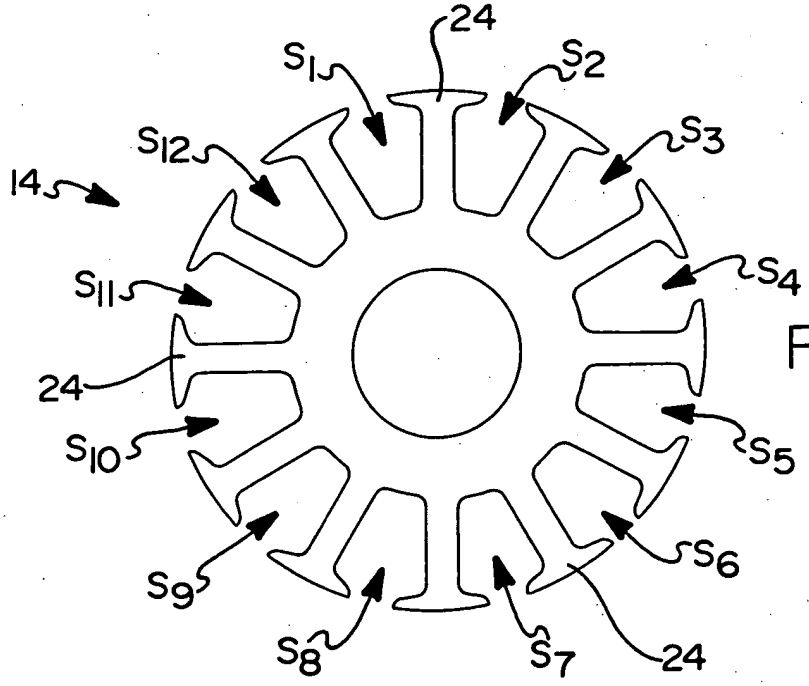


FIG 3

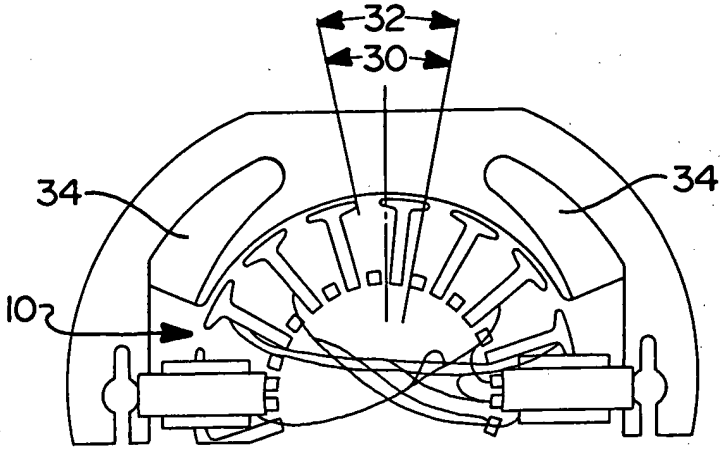


FIG 5

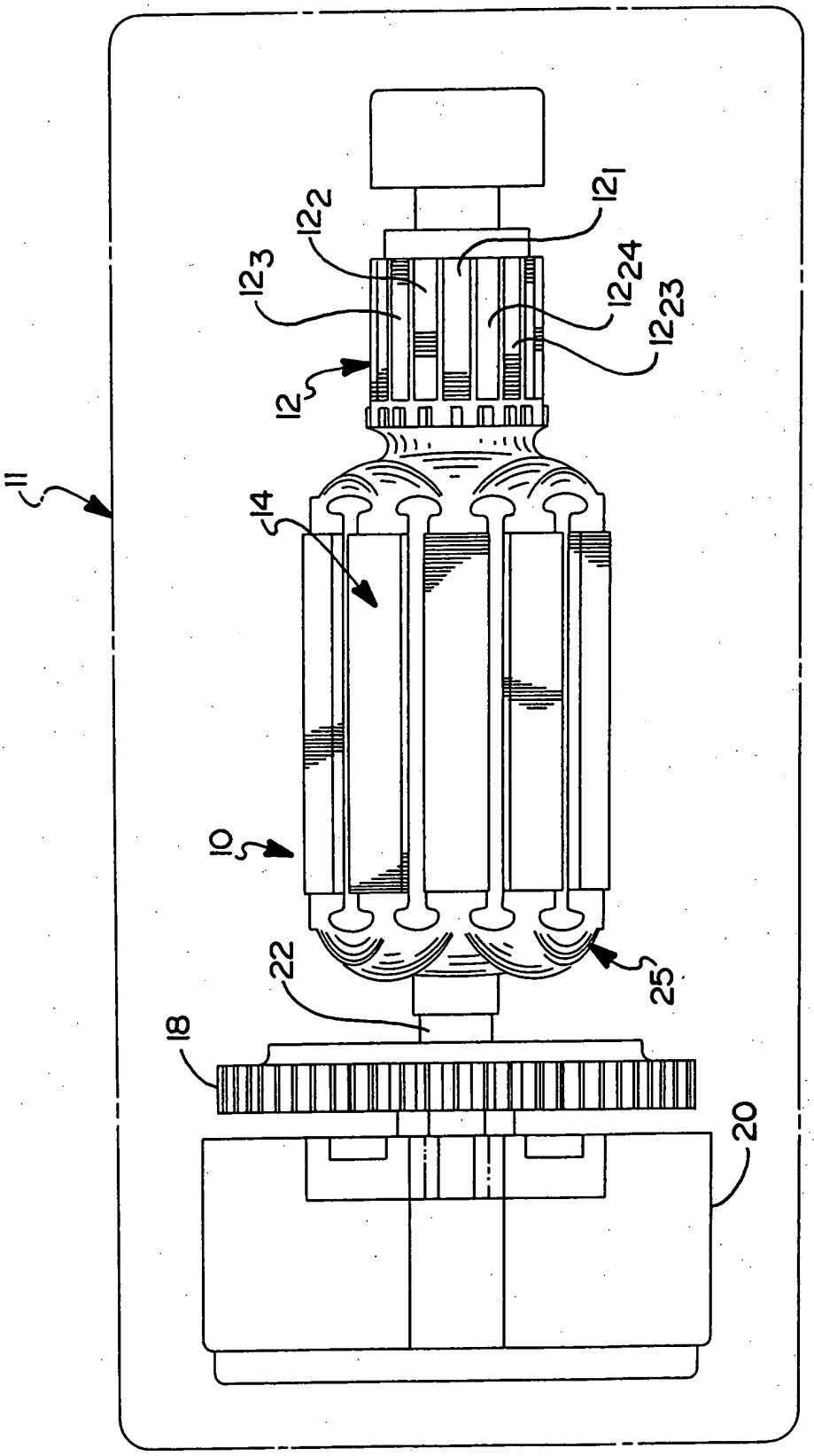


FIG 2

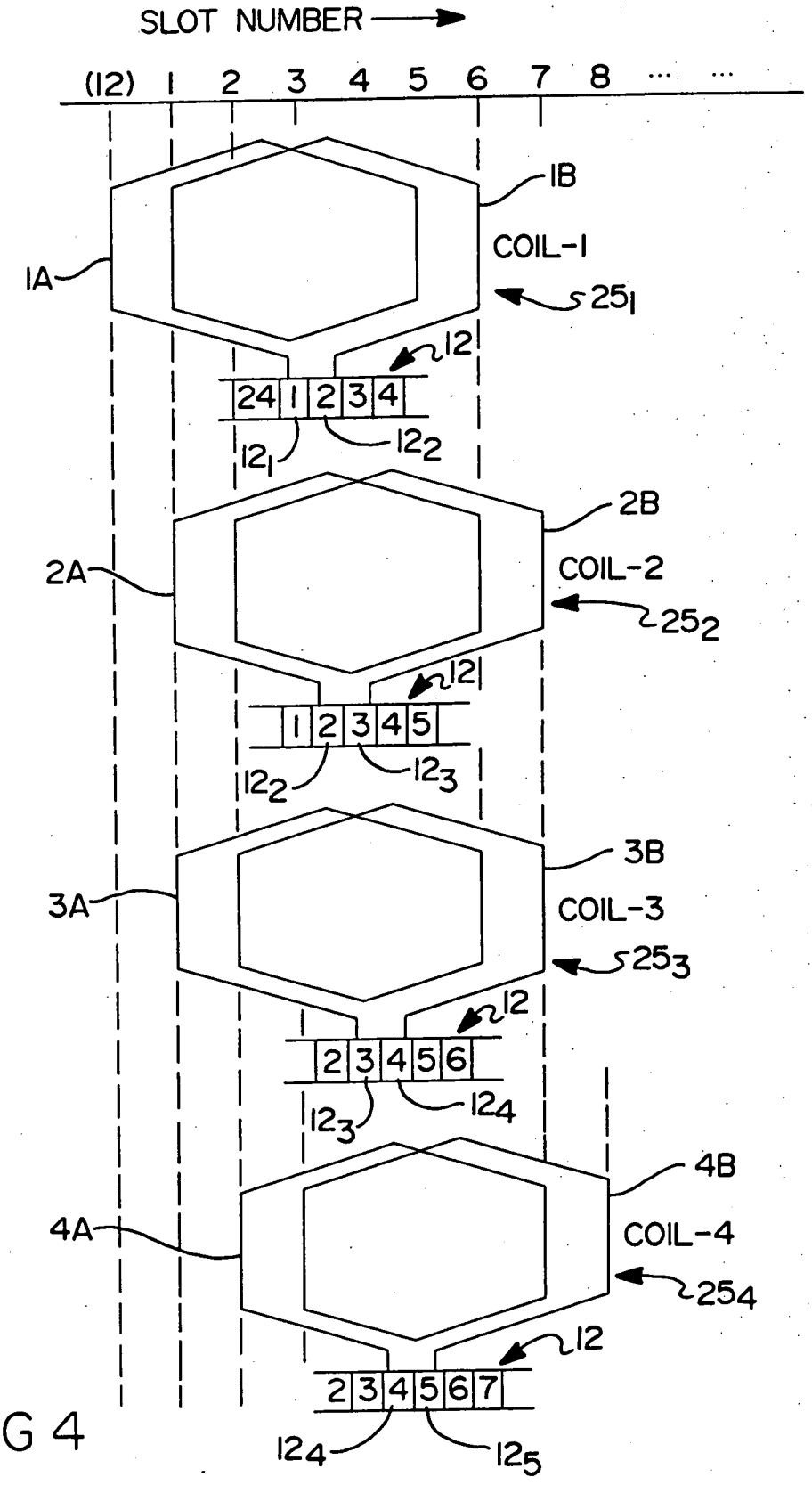

SLOT NUMBER
(12) 1 2 3 4 5 6 7 8 ... ...
1B
COIL-1
1A
25₁
12
24 1 2 3 4
12₁
12₂
2B
2A
COIL-2
25₂
12
1 2 3 4 5
12₂
12₃
3B
3A
COIL-3
25₃
12
2 3 4 5 6
12₃
12₄
4B
4A
COIL-4
25₄
12
2 3 4 5 6 7
12₄
12₅

FIG 4

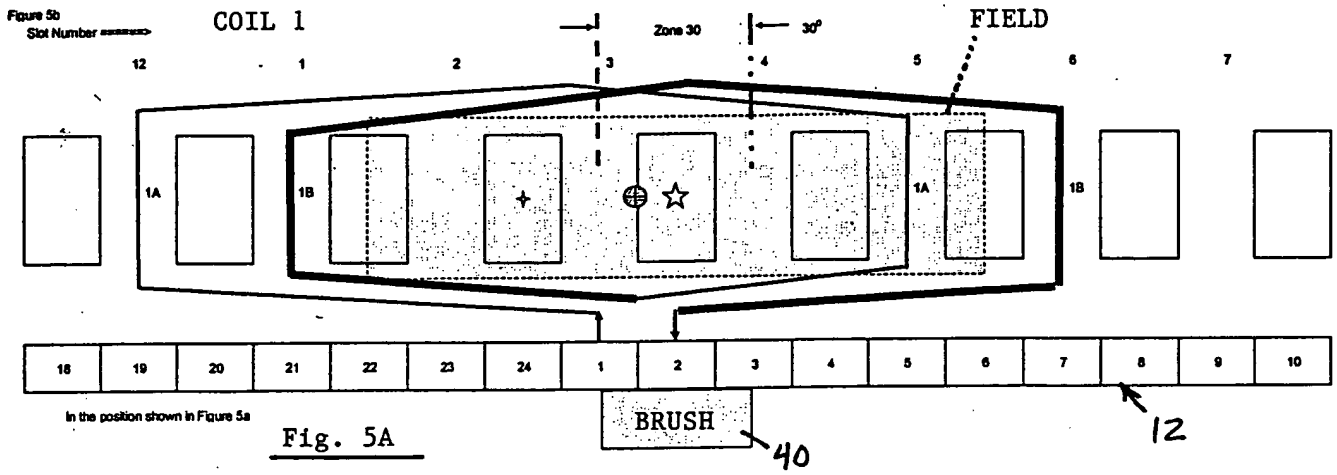


Figure 5b
Slot Number
COIL 1
Zone 30
30°
FIELD
12
1
2
3
4
5
6
7
1A
1B
1A
1B
18
19
20
21
22
23
24
1
2
3
4
5
6
7
8
9
10
In the position shown in Figure 5a
BRUSH
40
12

Fig. 5A

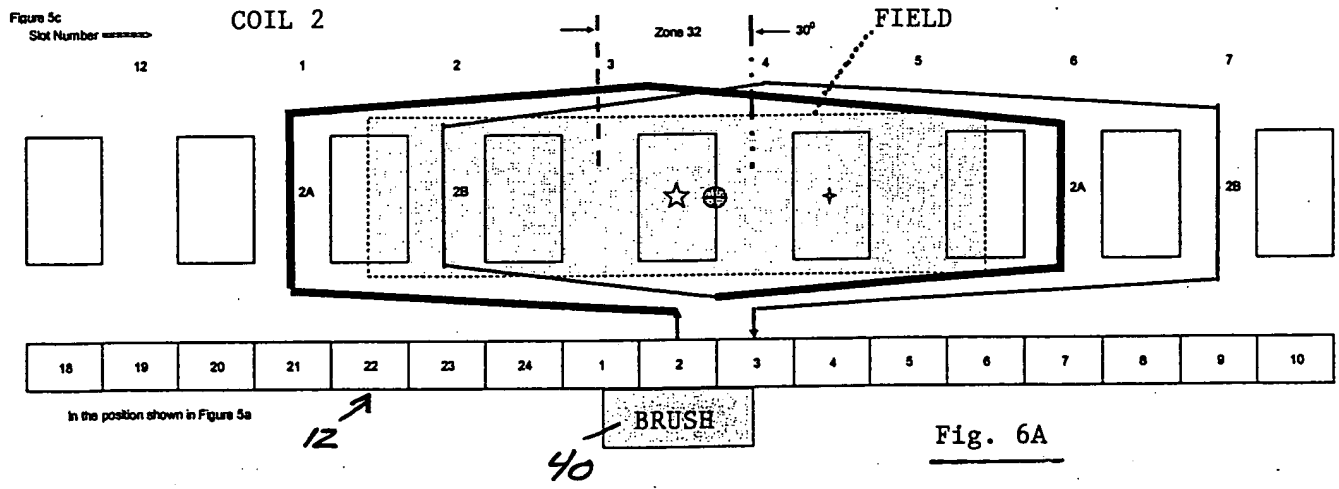
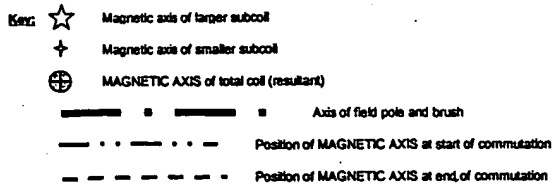


Figure 5c
Slot Number
COIL 2
Zone 32
30°
FIELD
12
1
2
3
4
5
6
7
2A
2B
2A
2B
18
19
20
21
22
23
24
1
2
3
4
5
6
7
8
9
10
In the position shown in Figure 5a
12
BRUSH
40

Fig. 6A


Key:
Magnetic axis of larger subcoil
Magnetic axis of smaller subcoil
MAGNETIC AXIS of total coil (resultant)
Axis of field pole and brush
Position of MAGNETIC AXIS at start of commutation
Position of MAGNETIC AXIS at end of commutation

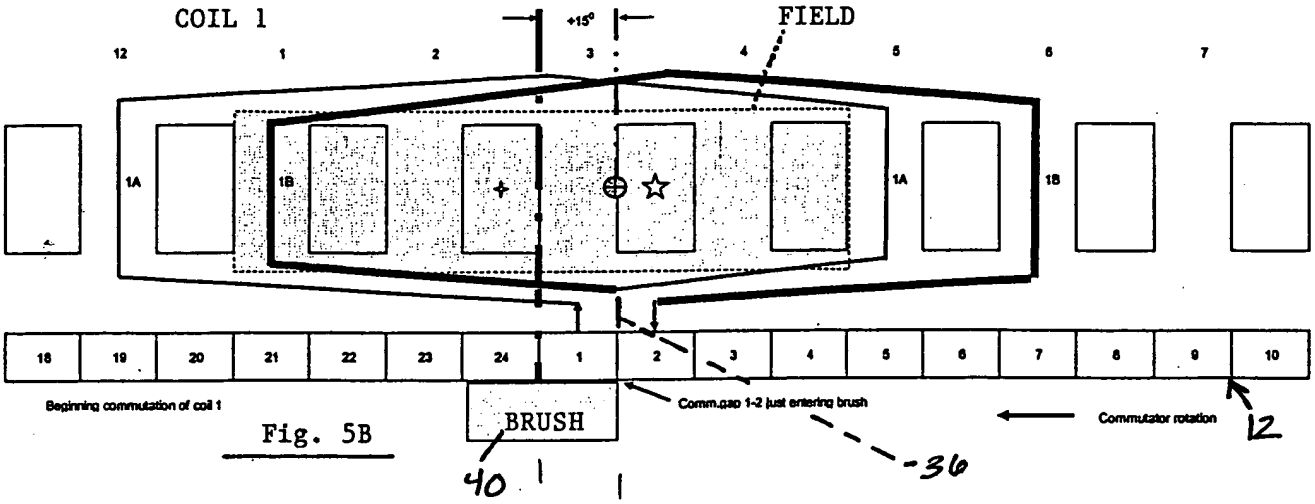

COIL 1
+15°
FIELD
12
1
2
3
4
5
6
7
1A
1B
1A
1B
18
19
20
21
22
23
24
1
2
3
4
5
6
7
8
9
10
Beginning commutation of coil 1
BRUSH
Comm.gap 1-2 just entering brush
Commutator rotation
12
36
40

Fig. 5B

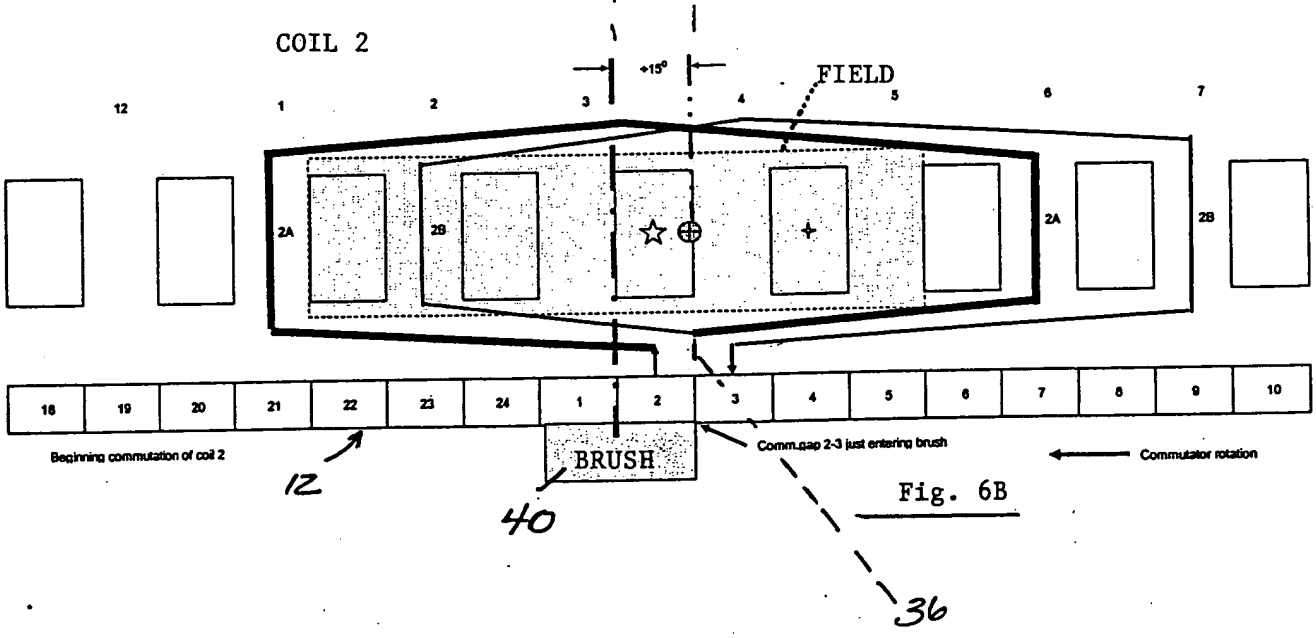
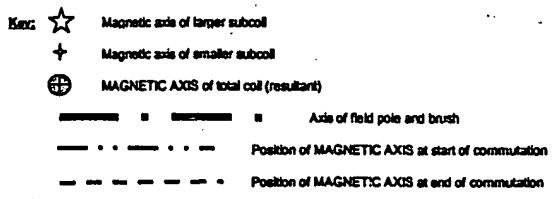

COIL 2
+15°
FIELD
12
1
2
3
4
5
6
7
2A
2B
2A
2B
18
19
20
21
22
23
24
1
2
3
4
5
6
7
8
9
10
Beginning commutation of coil 2
BRUSH
Comm.gap 2-3 just entering brush
Commutator rotation
12
40
36

Fig. 6B


KEY:
Magnetic axis of larger subcoil
Magnetic axis of smaller subcoil
MAGNETIC AXIS of total coil (resultant)
Axis of field pole and brush
Position of MAGNETIC AXIS at start of commutation
Position of MAGNETIC AXIS at end of commutation

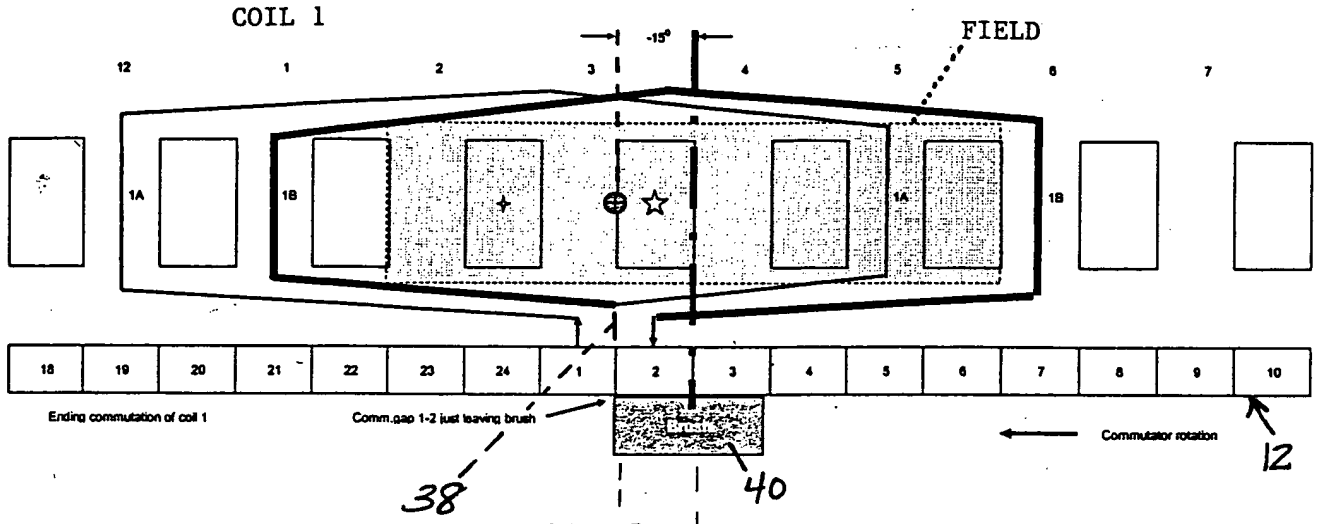

COIL 1
FIELD
-15°
12
1
2
3
4
5
6
7
1A
1B
1A
1B
18
19
20
21
22
23
24
1
2
3
4
5
6
7
8
9
10
Ending commutation of coil 1
Comm.gap 1-2 just leaving brush
Commutator rotation
38
40
12

Fig. 5C

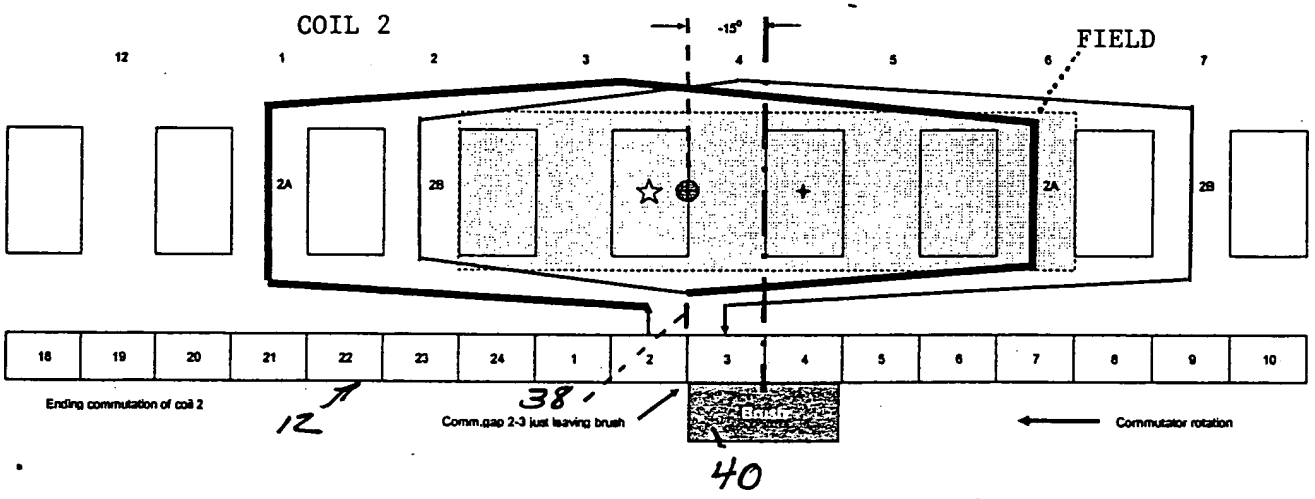
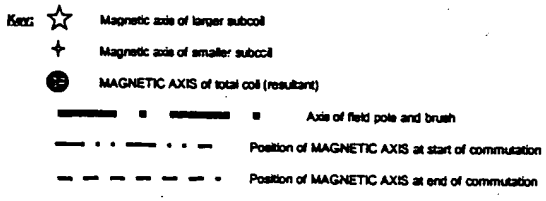

COIL 2
FIELD
-15°
12
1
2
3
4
5
6
7
2A
2B
2A
2B
18
19
20
21
22
23
24
1
2
3
4
5
6
7
8
9
10
Ending commutation of coil 2
Comm.gap 2-3 just leaving brush
Commutator rotation
12
38
40

Fig. 6C


Key:
Magnetic axis of larger subcoil
Magnetic axis of smaller subcoil
MAGNETIC AXIS of total coil (resultant)
Axis of field pole and brush
Position of MAGNETIC AXIS at start of commutation
Position of MAGNETIC AXIS at end of commutation

	Subcoil A slots	Subcoil B slots
1	$(12/5)^{7}$	$(1/6)^{17}$
2	$(1/6)^{17}$	$(2/7)^{7}$
3	$(1/6)^{7}$	$(2/7)^{17}$
4	$(2/7)^{17}$	$(3/8)^{7}$
5	$(2/7)^{7}$	$(3/8)^{17}$
6	$(3/8)^{17}$	$(4/9)^{7}$
7	$(3/8)^{7}$	$(4/9)^{17}$
8	$(4/9)^{17}$	$(5/10)^{7}$
9	$(4/9)^{7}$	$(5/10)^{17}$
10	$(5/10)^{17}$	$(6/11)^{7}$
11	$(5/10)^{7}$	$(6/11)^{17}$
12	$(6/11)^{17}$	$(7/12)^{7}$
13	$(6/11)^{7}$	$(7/12)^{17}$
14	$(7/12)^{17}$	$(8/1)^{7}$
15	$(7/12)^{7}$	$(8/1)^{17}$
16	$(8/1)^{17}$	$(9/2)^{7}$
17	$(8/1)^{7}$	$(9/2)^{17}$
18	$(9/2)^{17}$	$(10/3)^{7}$
19	$(9/2)^{7}$	$(10/3)^{17}$
20	$(10/3)^{17}$	$(11/4)^{7}$
21	$(10/3)^{7}$	$(11/4)^{17}$
22	$(11/4)^{17}$	$(12/5)^{7}$
23	$(11/4)^{7}$	$(12/5)^{17}$
24	$(12/5)^{17}$	$(1/6)^{7}$

COIL

Example: $(12/5)^{7}$ = 7 turns around slots 12 and 5

Figure 7

SLOTS

Winding Turns	12	1	2	3	4	5	6	7	8	9	10	11
	7_{1A}	17_{1B}	7_{2B}	7_{4B}	7_{6B}	7_{1A}	17_{1B}	7_{2B}	7_{4B}	7_{6B}	7_{8B}	7_{10B}
	7_{12B}	17_{2A}	17_{3B}	17_{5B}	17_{7B}	7_{8B}	17_{2A}	17_{3B}	17_{5B}	17_{7B}	17_{9B}	17_{11B}
	17_{13B}	7_{3A}	17_{4A}	17_{6A}	17_{8A}	17_{9B}	7_{3A}	17_{4A}	17_{6A}	17_{8A}	17_{10A}	17_{12A}
	17_{14A}	7_{14B}	7_{5A}	7_{7A}	7_{9A}	17_{10A}	7_{10B}	7_{5A}	7_{7A}	7_{9A}	7_{11A}	7_{13A}
	7_{15A}	17_{15B}	7_{16B}	7_{18B}	7_{20B}	7_{11A}	17_{11B}	7_{12B}	7_{14B}	7_{16B}	7_{18B}	7_{20B}
	7_{22B}	17_{16A}	17_{17B}	17_{19B}	17_{21B}	7_{22B}	17_{12A}	17_{13B}	17_{15B}	17_{17B}	17_{19B}	17_{21B}
	17_{23A}	7_{17A}	17_{18A}	17_{20A}	17_{22A}	17_{23B}	7_{13A}	17_{14A}	17_{16A}	17_{18A}	17_{20A}	17_{22A}
	17_{24A}	7_{24B}	7_{19A}	7_{21A}	7_{23A}	17_{24A}	7_{24B}	7_{15A}	7_{17A}	7_{19A}	7_{21A}	7_{23A}
Total	96	96	96	96	96	96	96	96	96	96	96	96

Examples:

= $7_{12B} = 7$ winding turns of subcoil 12B
= $17_{2A} = 17$ winding turns for subcoil 2A

Figure 8